IRS POWER CONTROLER FOR IR. OVENS

IRS10 and IRS12

PROFIBUS AND AUTOMATION EXAMPLE WITH OMRON PLC CJ1M and PROFIBUS MASTER VERSION PRM21

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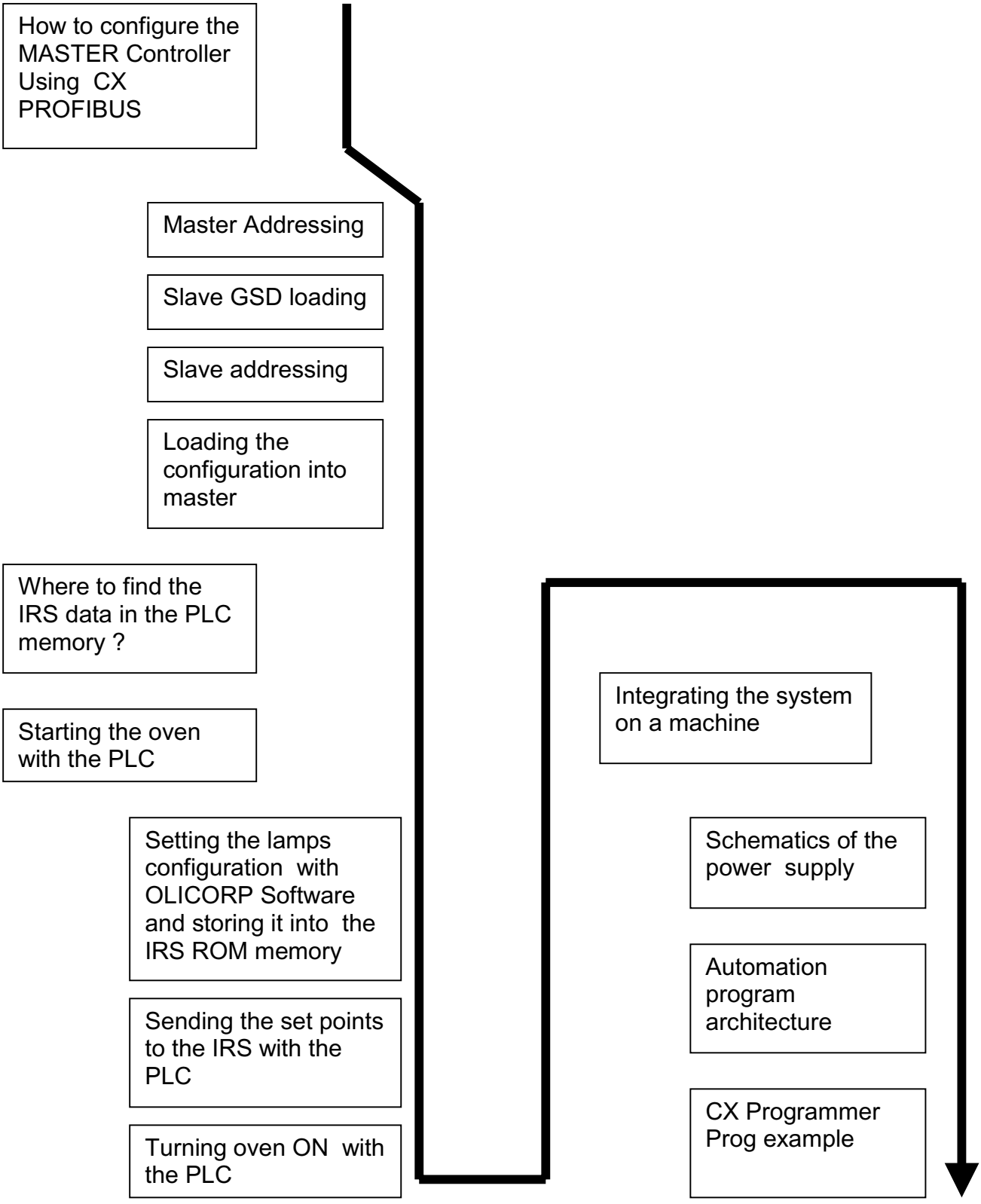
How to configure the MASTER Controller Using CX PROFIBUS
Master Addressing
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Slave addressing
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Turning oven ON with the PLC
Integrating the system on a machine
Schematics of the power supply
Automation program architecture
CX Programmer Prog example

CE relevant european directives

Low Voltage compliance

The IRS products carry the CE mark in compliance with the essential requirements of the European Low Voltage Directive 73/23/EEC of 19/2/73, amended by the directive 93/68/EEC of 22/7/93.

The IRS products installed and used in compliance with the procedures described in the present document meet the essential requirements of the European Low Voltage Directive.

EMC compliance

The IRS products are compliant with the EMC requirements with respect to the European directives 89-336/EEC of the 05//03/89 amended by the 91-263/EEC, 92-31/EEC, 93-68/EEC, 93-97/EEC. The enforcement of this directives is done by standards : EN60204, EN50081-2 and EN50081-3

EM compliance has been certified by an approved EMC testing laboratory. Certificates are available upon request.

More details about EM compliance are given later in this document.

CE Label

By fulfilling the requirements of the Low voltage and EMC regulations, the IRS products are compliant with the CE directives.

CSA / CUS® Marking

The IRS products CSA/UL compliance has been investigated by the CSA laboratories in Toronto, Canada. (May 2007). File number 1871799.

Profibus® standard compliance

The IRS carries the Profibus-DP compliance label and is listed by the PNO organization under reference IRPC1012 with id number 0594Hex.

Safety and security aspects

Symbols :

This symbol means that failure to take note of the information given in this manual may have serious consequences for the safety of the personnel or may result in electrocution.

This symbol means that failure to take note of the information given in this manual may have serious consequences for the installation, lead to incorrect operation of the product, or may damage the product.

Safety :

The installation, configuration, commissioning and maintenance of the IRS products must only be carried out by personnel qualified and trained to work with low voltage electrical equipment in an industrial environment.

The front door should not be opened except by competent technicians when connecting or disconnecting the device. Electrical isolation must be ensured between the equipment and the power supply.

In both off and on modes, the IRS regulator doesn't ensure isolation from the power supply. One should pay attention to the fact that electrical shock may occure when touching the lamps or the cables coming from the IRS.
It is thus recommended to turn off the power supply (400 V) within 2 sec following the end of regulation.

PART 1 : SETTING UP THE COMMUNICATION BETWEEN THE OMRON PLC AND THE IRS

NETWORK SETTINGS

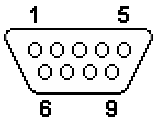
Hardware used in the example :

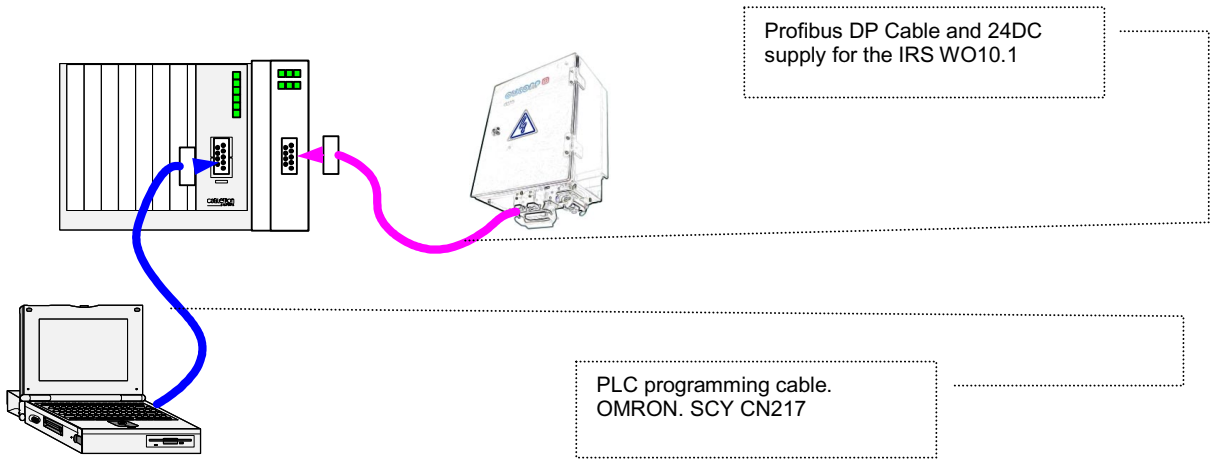
- IRS 10 or 12 Firwmare 5.X
- PLC Omron® CJ1M CPU 11
- Master Module Omron CJ1W-PRM21®
- 24DC supply 350 mA for the IRS
- Cable RS232 for Omron PLC programation SCY-CN217
- Cable RS232 Null Modem for IRS configuration
- OLICORP – Hybdrid Profibus Cable equipped with DB9 on one side for the connection PLC-IRS Ref : WO.10.1

Diagrams for the Programming cables :

Signal	PC side	Omron PLC – SCY-CN217	OLICORP IRS 10/12 (NULL MODEM) WO10.1
FG	-	-	-
TD	3	3	2
RD	2	2	3
RTS	7	5	8
CTS	8	4	7
SG	5	9	5
DSR	6	-	4
DTR	4	-	6
TYPE CONN	DB9 – FEMALE	DB 9 MALE	DB 9 FEMALE

Pin out DB9 Male side





First Step : Installing the PLC

The PLC and PRM21 Master must be set according to Omron Spec.
In our example, PRM21 is set as Slot ID = 0 using the wheel on the front.

The IRS is connected to the PRM21 via a profibus cable.

Reminder : If it necessary to build a specific Profibus cable the pin out on the master is the following :

Pin 8 : Channel A Green cable
Pin 3 : Channel B Red Cable

At the first boot the ERC led of the PRM21 master will turn red because the PLC and Master have not been configured yet.

Second step : configuring the network

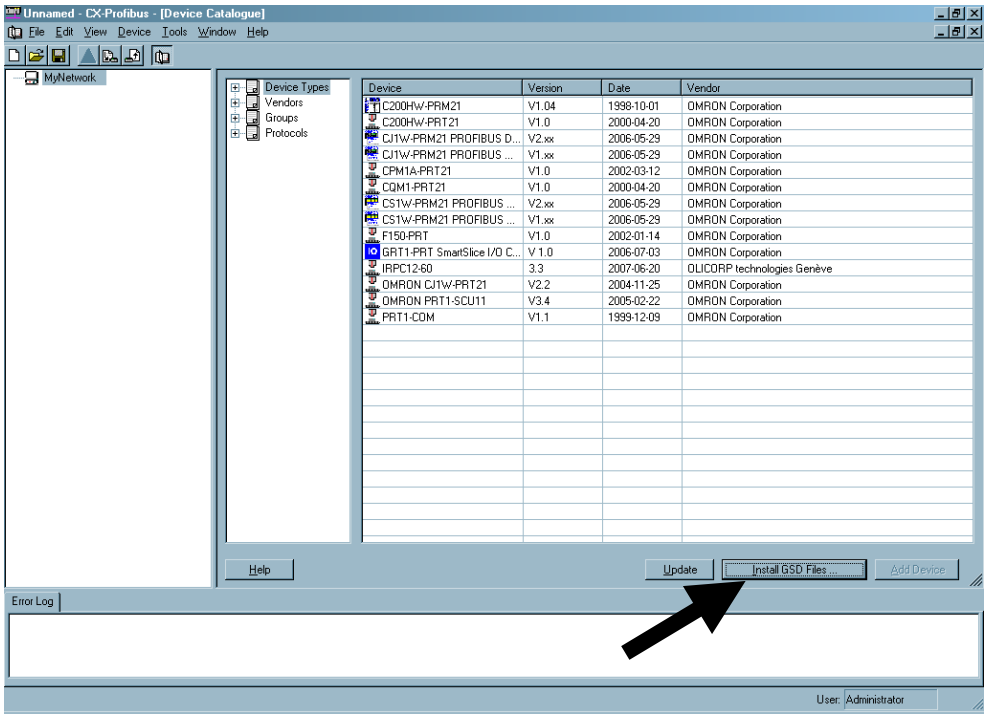
The purpose of this step is to send the required information about the network structure to the PLC.

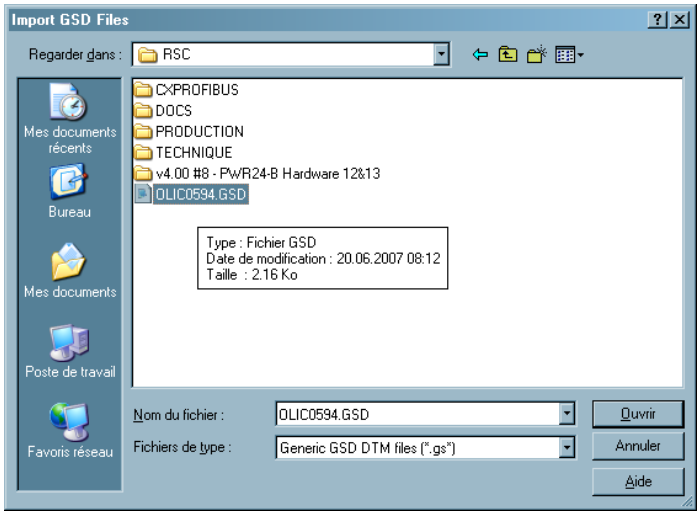
- Type of Master
- List of slaves present on the network and their associated protocols.
- Profibus addresses of master and slaves

To do so, we use the OMRON CX PROFIBUS 1.0 software which will transfer this information the master module through the PLC.

See the following pictures to follow the configuration process :

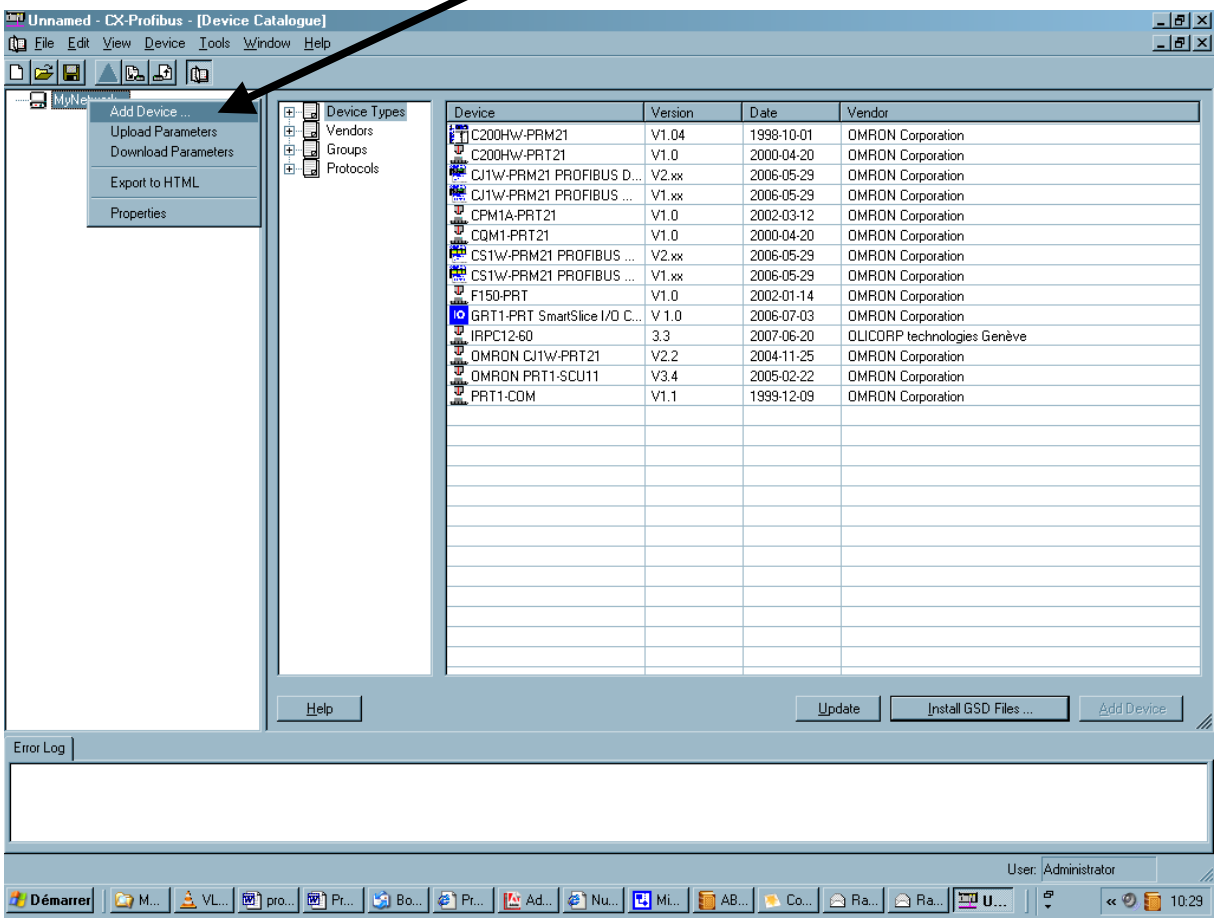
A. Import OLICORP GSD file in the system :

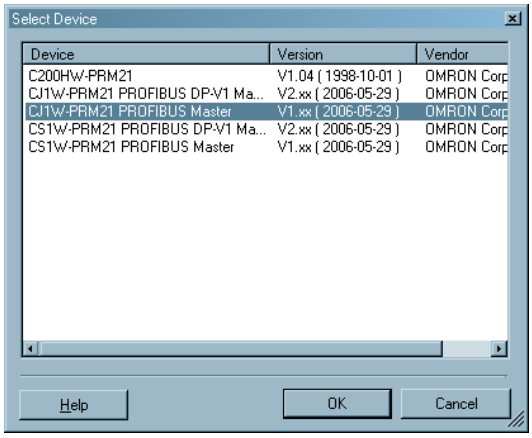

Unnamed - CX-Profibus - [Device Catalogue]
File Edit View Device Tools Window Help
MyNetwork
Device Types
Vendors
Groups
Protocols
Device Version Date Vendor
C200HW-PRM21 V1.04 1998-10-01 OMRON Corporation
C200HW-PRT21 V1.0 2000-04-20 OMRON Corporation
CJ1W-PRM21 PROFIBUS D... V2.xx 2006-05-29 OMRON Corporation
CJ1W-PRM21 PROFIBUS ... V1.xx 2006-05-29 OMRON Corporation
CPM1A-PRT21 V1.0 2002-03-12 OMRON Corporation
CQM1-PRT21 V1.0 2000-04-20 OMRON Corporation
CS1W-PRM21 PROFIBUS ... V2.xx 2006-05-29 OMRON Corporation
CS1W-PRM21 PROFIBUS ... V1.xx 2006-05-29 OMRON Corporation
F150-PRT V1.0 2002-01-14 OMRON Corporation
GRT1-PRT SmartSlice I/O C... V 1.0 2006-07-03 OMRON Corporation
IRPC12-60 3.3 2007-06-20 OLICORP technologies Genève
OMRON CJ1W-PRT21 V2.2 2004-11-25 OMRON Corporation
OMRON PRT1-SCU11 V3.4 2005-02-22 OMRON Corporation
PRT1-COM V1.1 1999-12-09 OMRON Corporation
Help
Update
Install GSD Files...
Add Device
Error Log
User: Administrator



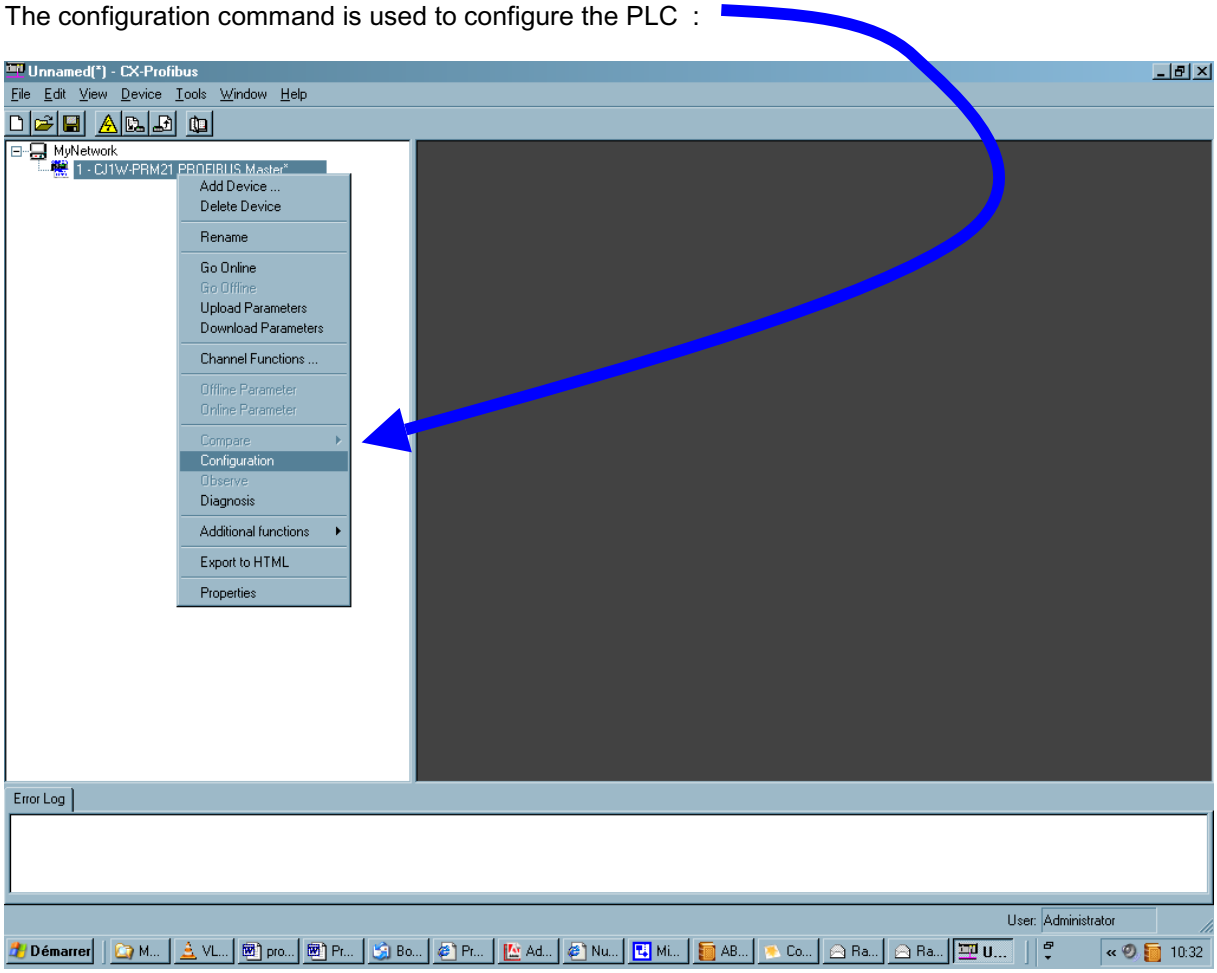
B : Configure the Network :

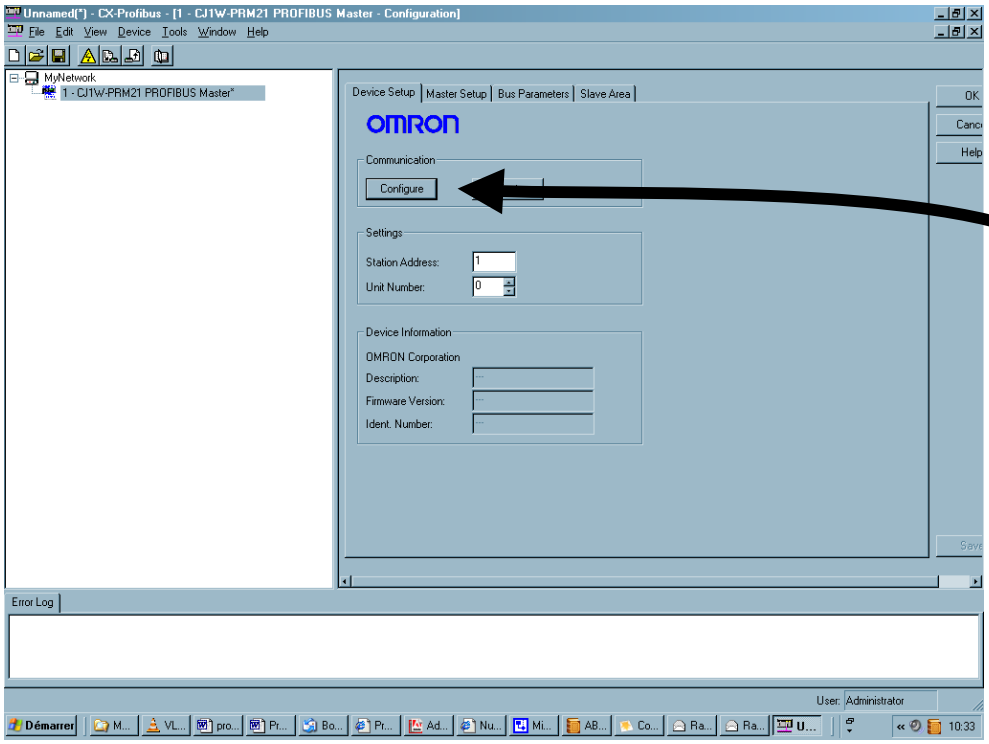
Use the Add device command to add the PLC





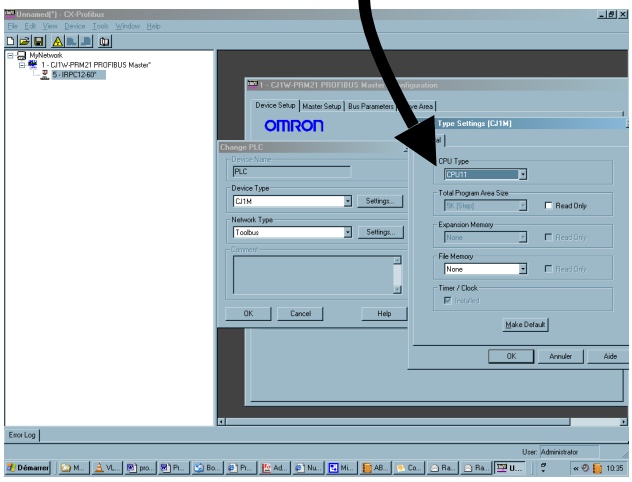
The configuration command is used to configure the PLC :

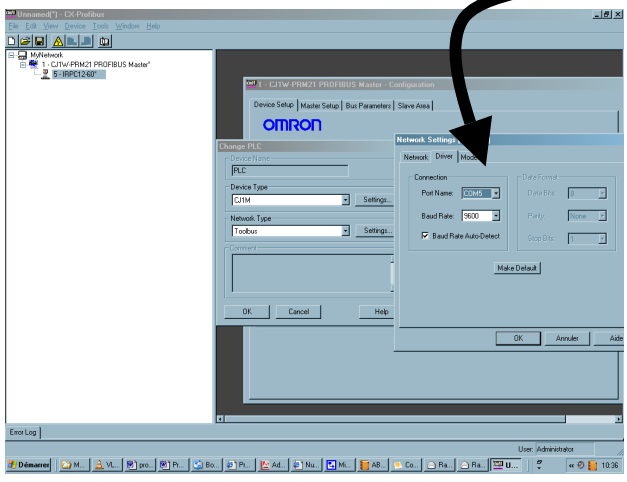




In the configuration Panel it is necessary to check the following information

- version for the PLC CPU (here CJM1 11)
- Which COM interface to use to connect to the Master through the CPU (here 5)

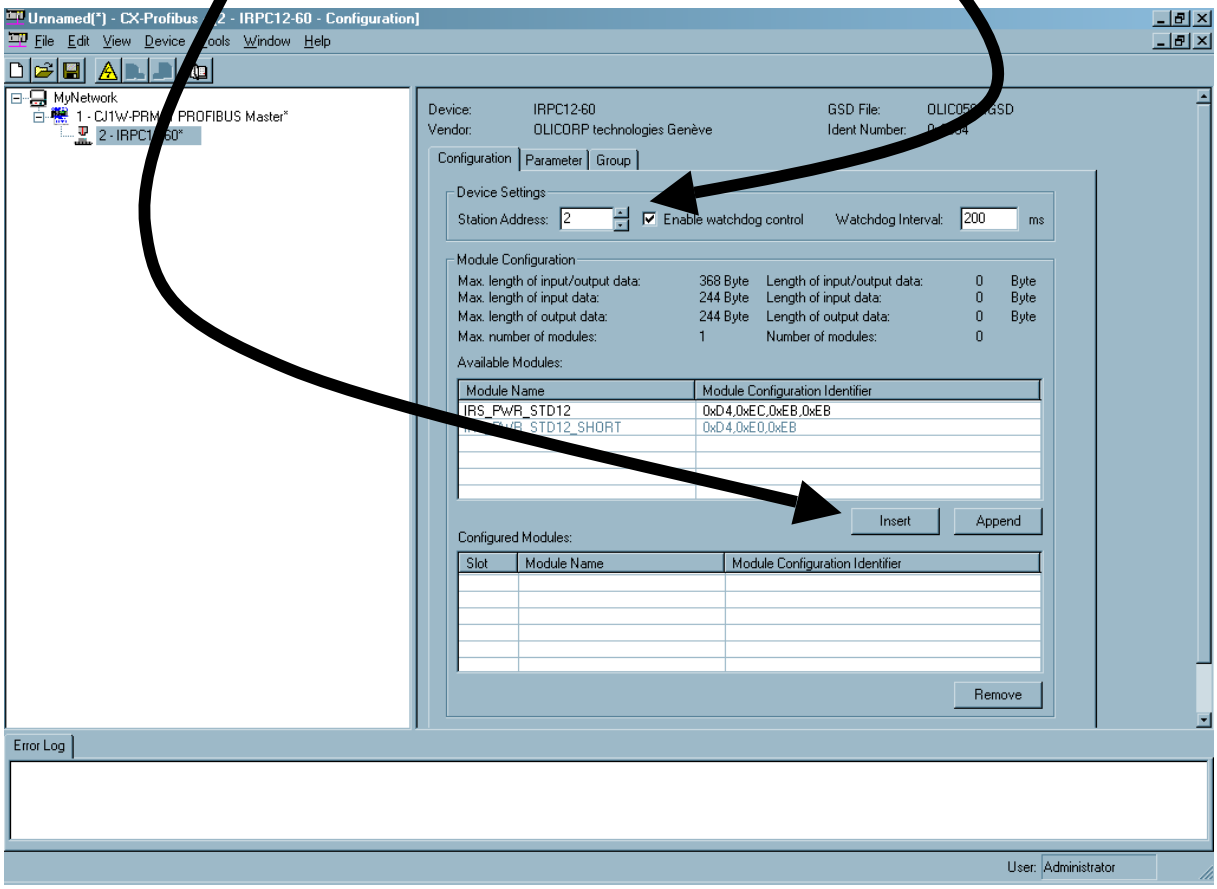




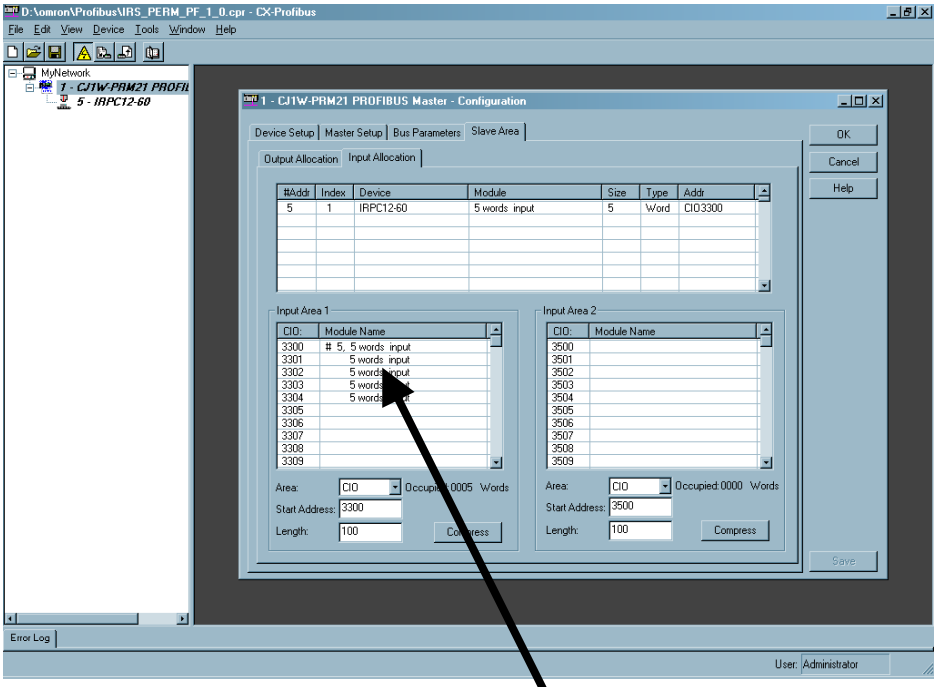
The Slaves must be added the same way.

For each IRS slave it is necessary to configure the Profibus DP address (must be the same on the wheels in the IRS cabinet, and on the Profibus Configurator).

A specific protocol must be selected for each slave.

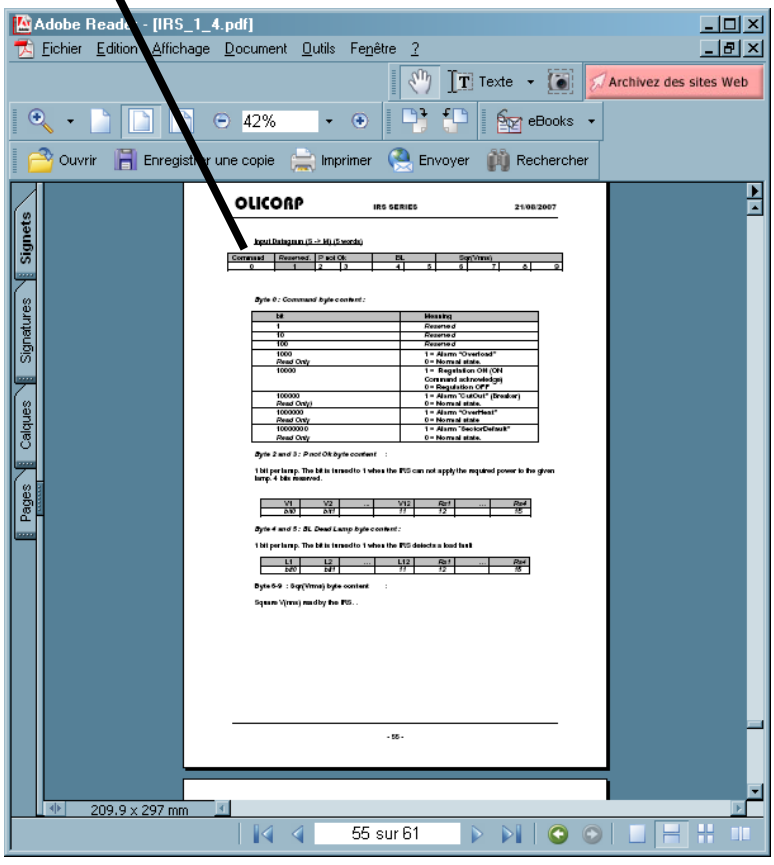


The system automatically associate the input / Output datagram with a specific CIO address in the PLC memory.

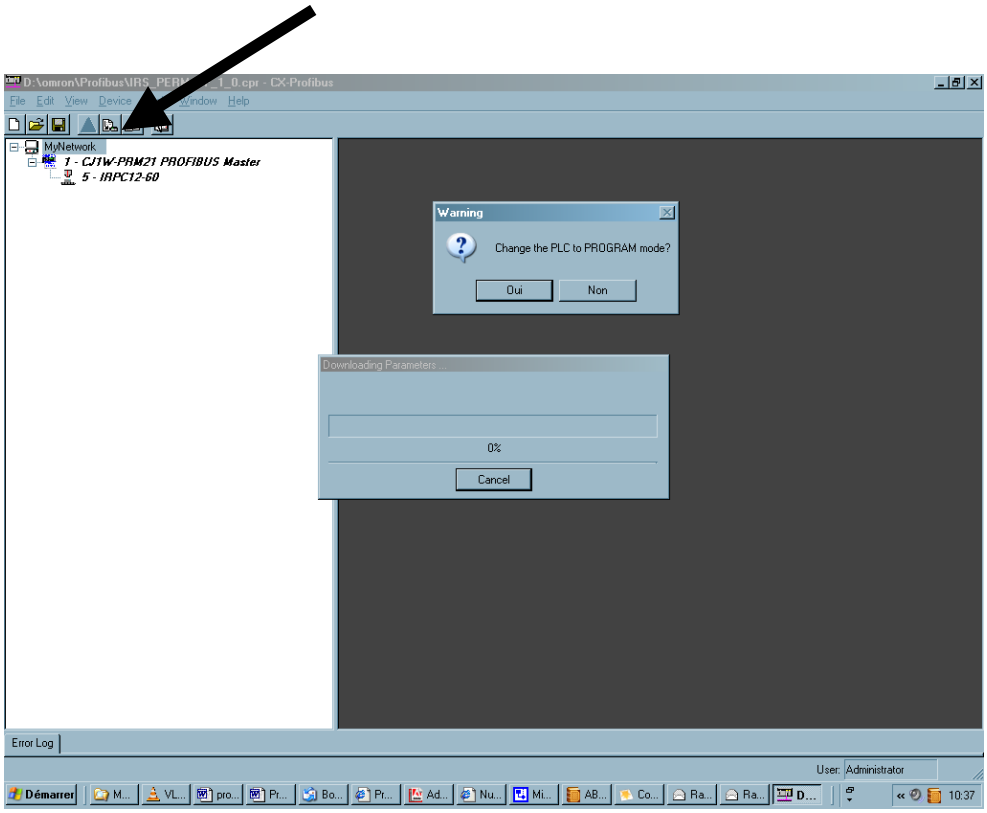


When writing the automation program in the next step, one will have to refer to the content of these addresses to exchange data with the IRS system

See technical documentation of IRS to find the description of the datagrams

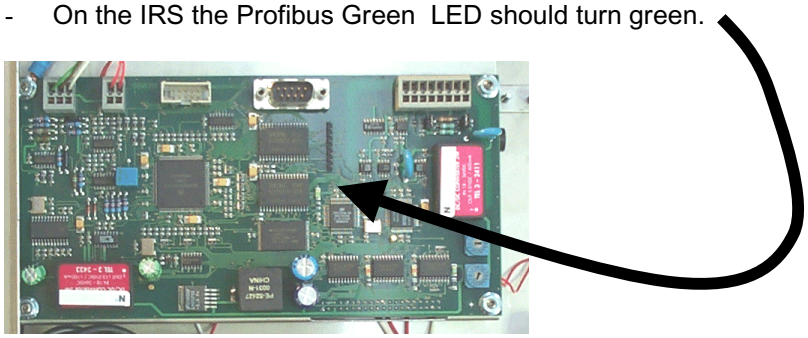


At this point, it is possible to Download the configuration to the PLC and the master using the download command.



The process is finished.
All LEDs should be green :

- on Master PRM21, the ERC turns to green. The BF may be orange if there is a missing component on the network.
- On the IRS the Profibus Green LED should turn green.



If NOT :

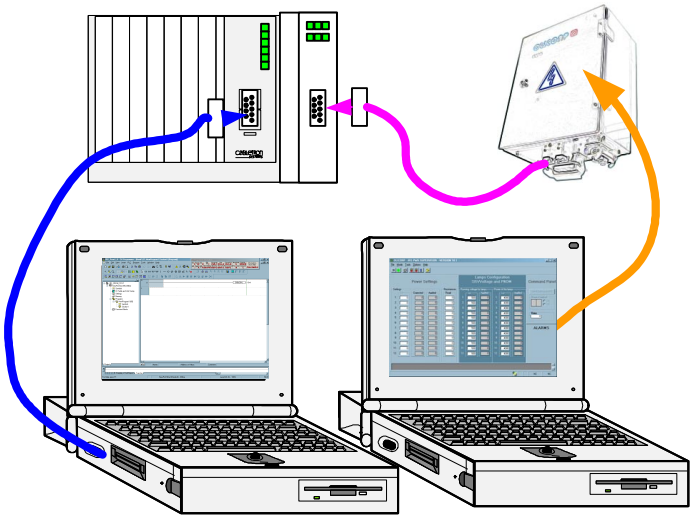
- Try to reboot PLC and IRS
- Check cabling
- Check Profibus Adresses
- Reload configuration

PLC SETTINGS AND DATA ACCESS :

Tools :

For the automation programming we are using :

- CX programmer OMRON Version 7.0
- OLICORP Supervisor 10.1 to cross check the information sent to the IRS by the PLC and to store the lamps configuration and running options in the IRS.



IRS Data Access from PLC :

When setting the network we have selected the following information :

- PLC MASTER is on slot 0.
- PLC Master has profibus ID 1
- IRS Slave is connected to the Master and has Notwork ID : 5
- IRS uses the **IRSPWR_STD_SHORT** protocol.

The Profibus Configurator program from OMRON has given the following information to us :

- The output datagram is 13 words long and has 1 word from address 3200 and 12 words from address 3201
- The input datagram is 5 words long and starts at address CIO 3300

By using the protocol description in IRS technical manual it is possible to associate this information with the basic parameters to be sent or received to/from the Irs.

NOTE THAT HIGH AND LOW ORDER BYTES IN WORDS ARE INVERTED IN PLCs WITH RESPECT TO MOTOROLA 32b PROCESSORS.

So on the PLC bits 8-15 correspond to Byte 0 of IRS
And bits 0-7 correspond to Byte 1 of IRS

Data sent from PLC to IRS :

IRS Byte 0
PLC Byte 1

IRS Byte 1
PLC Byte 0

CIO	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
3200	-	-	-	ON/OFF	-	-	-	-	-	-	-	-	-	-	-	-
3201	POWER LAMP 1															
3202	POWER LAMP 2															
3203	POWER LAMP 3															
3204	POWER LAMP 4															
3205	POWER LAMP 5															
3206	POWER LAMP 6															
3207	POWER LAMP 7															
3208	POWER LAMP 8															
3209	POWER LAMP 9															
3210	POWER LAMP 10															
3211	POWER LAMP 11															
3212	POWER LAMP 12															

Data Sent from IRS to PLC :

CIO	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
3300	SD	OH	CO	OV	OL	-	-	-	-	-	-	-	-	-	-	-
3301	PNR1	PNR2	PNR3	PNR4	PNR5	PNR6	PNR7	PNR8	PNR9	PNR10	PNR11	PNR12				
3302	DL1	DL2	DL3	DL4	DL5	DL6	DL7	DL8	DL9	DL10	DL11	DL12				
3303	Square (Vrms)															
3304																

SD : Supply default
OH : Overheat
CO : Cut Out
OV : Oven On
OL : Overload

PNR : Power nor reached
DL : Dead Lamp
V : Vrms2

At this point, the communication between the IRS and the PLC is effective and one can easily use these data areas to control the IRS from the PLC.

Testing the IRS control with the Omron PLC

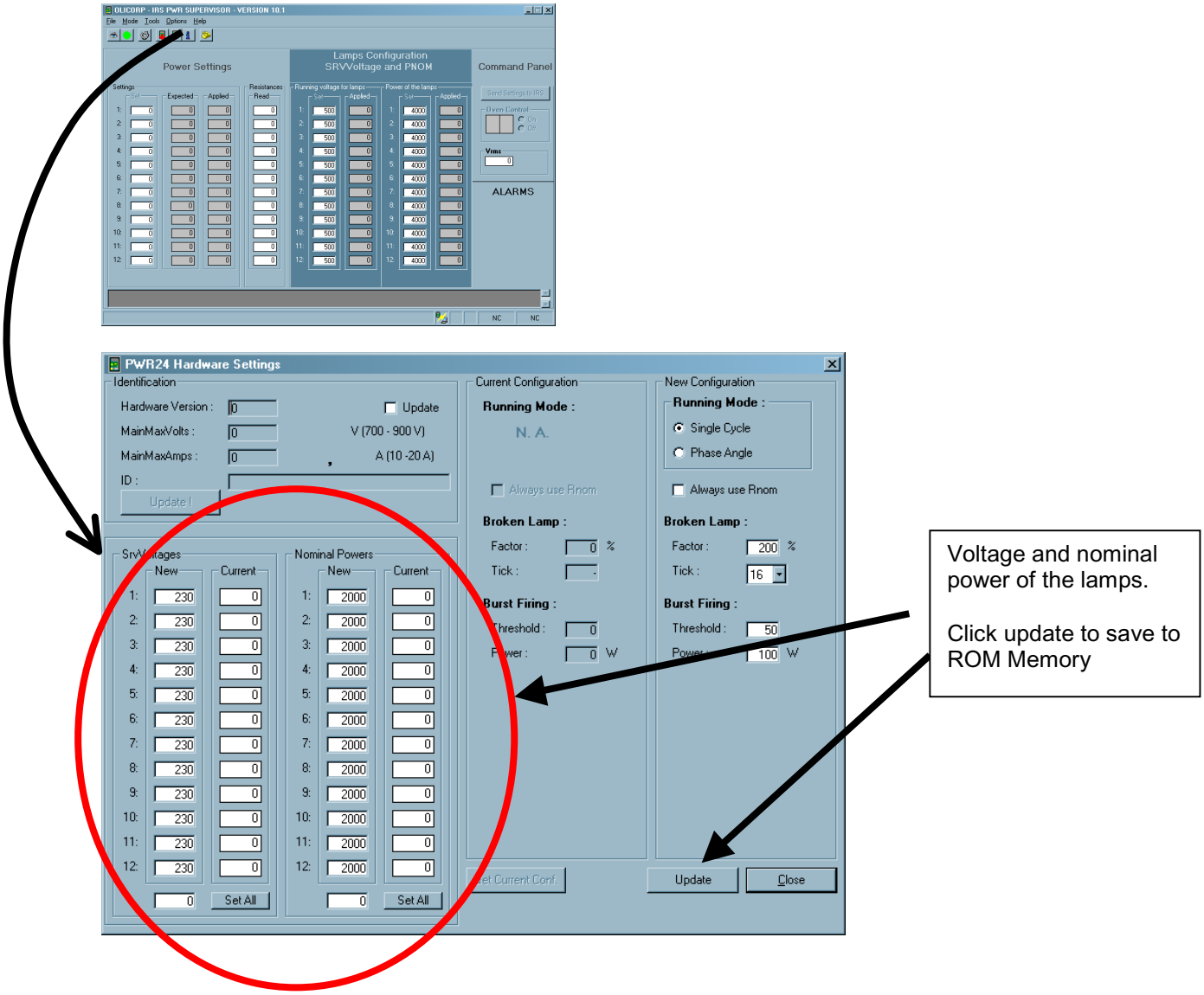
In this example it has been decided to use the **IRSPWR_STD_SHORT** protocol.
Using the SHORT version of the protocol is a great simplification for the PLC program, but it requires a pre-configuration of the IRS to store permanently the lamps configuration in the ROM memory of the IRS.

STEP 1 :

Storing the lamps configuration in the IRS using the SUPERVISOR or PWR24COM programs.

- Connect a PC were SUPERVISOR program is running to the IRS using the null modem cable.
- Start the SUPERVISOR and go to hardware settings menu.
- Set the lamps voltage and nominal power and save it by clicking update.
- Reboot the IRS.

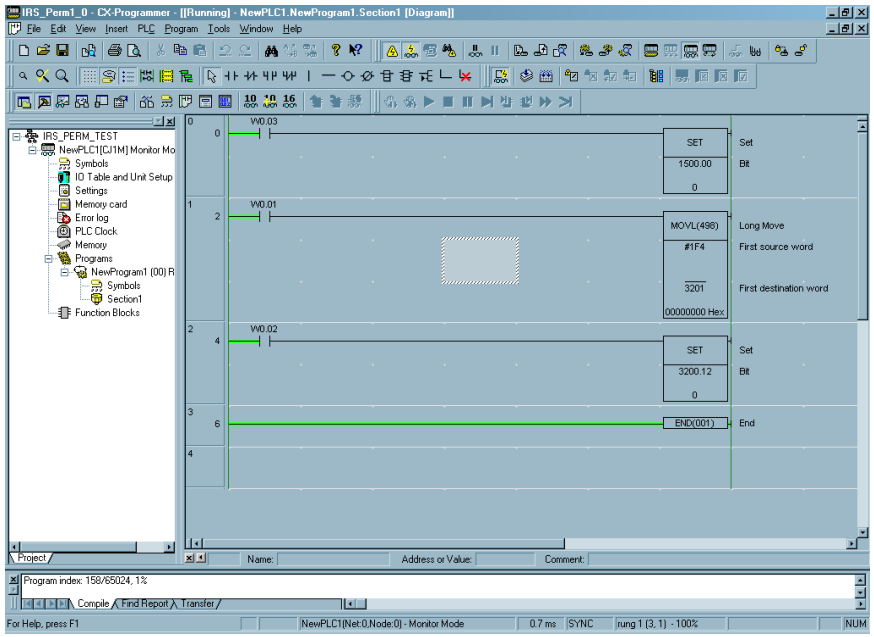
Note : During this step, one can also configure the running modes and options of the IRS. For more information refer to SUPERVISOR user's manual.

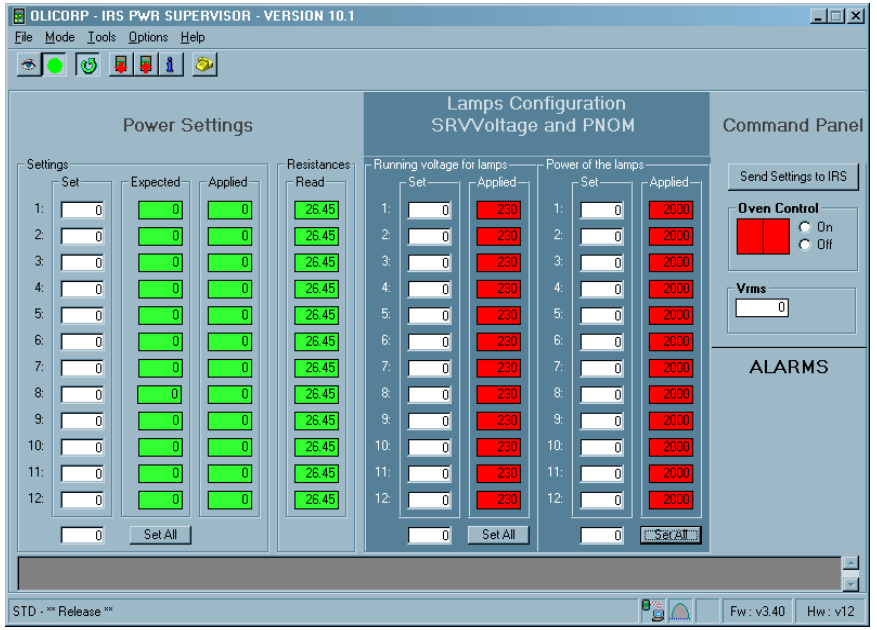


STEP 2 :

Sending the set points to the IRS from the PLC.

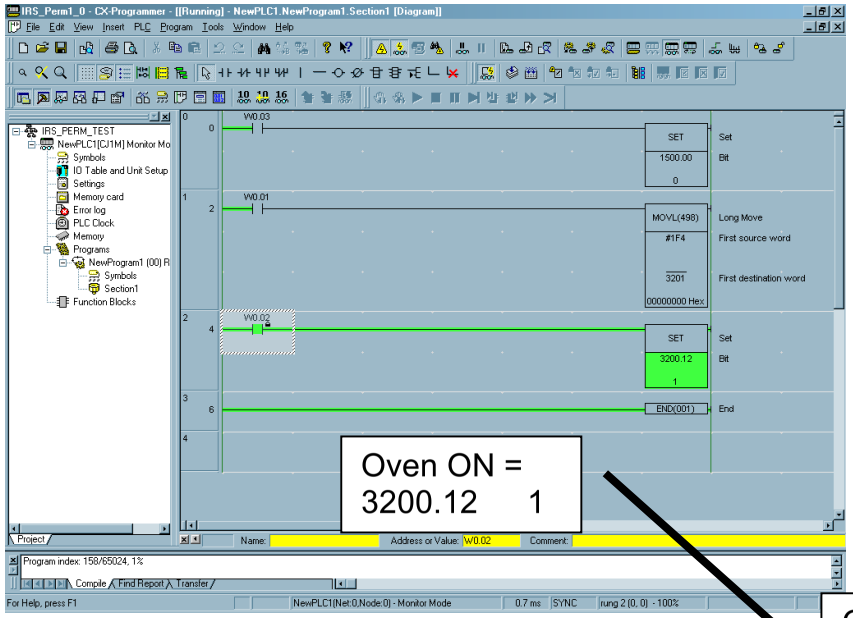
To ease the debugging process, we suggest to disconnect the oven to receive Dead lamp signals and thus to verify the position of each dead lamp bit in the PLC memory.

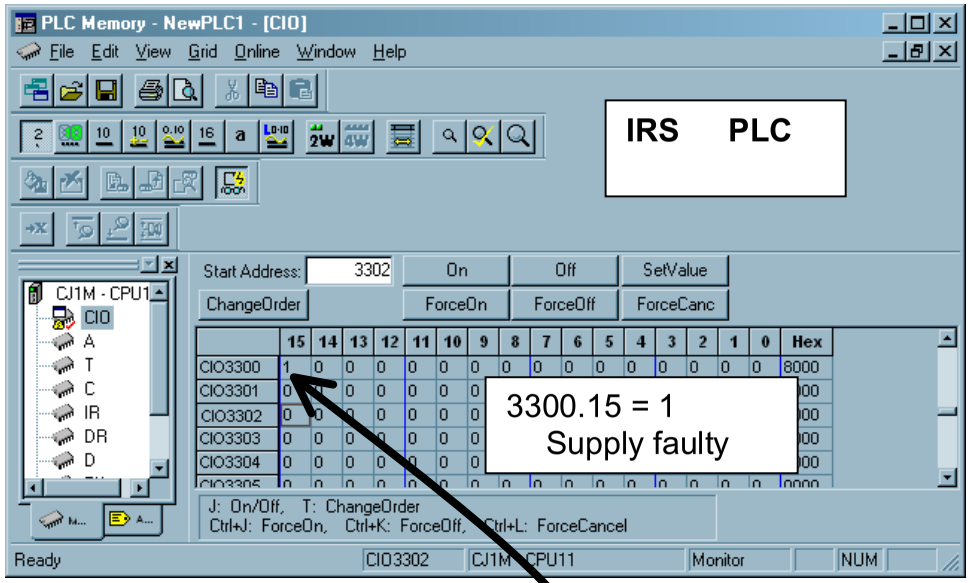




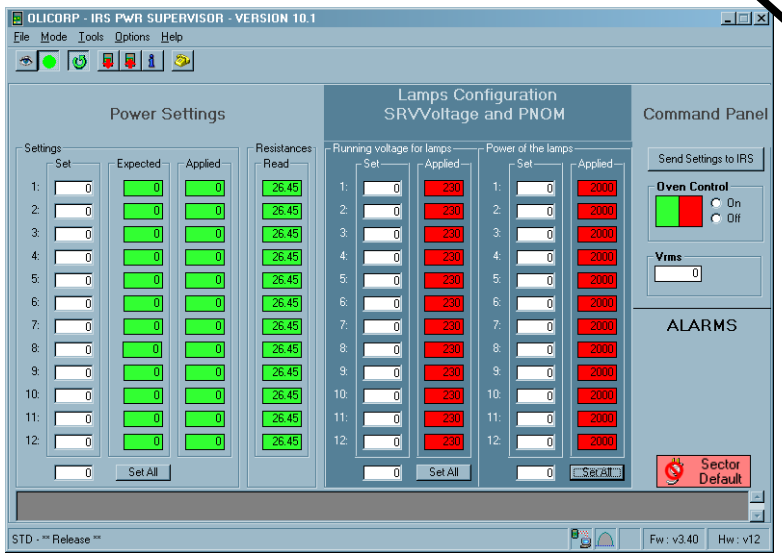
No setting – No 400 V - No command

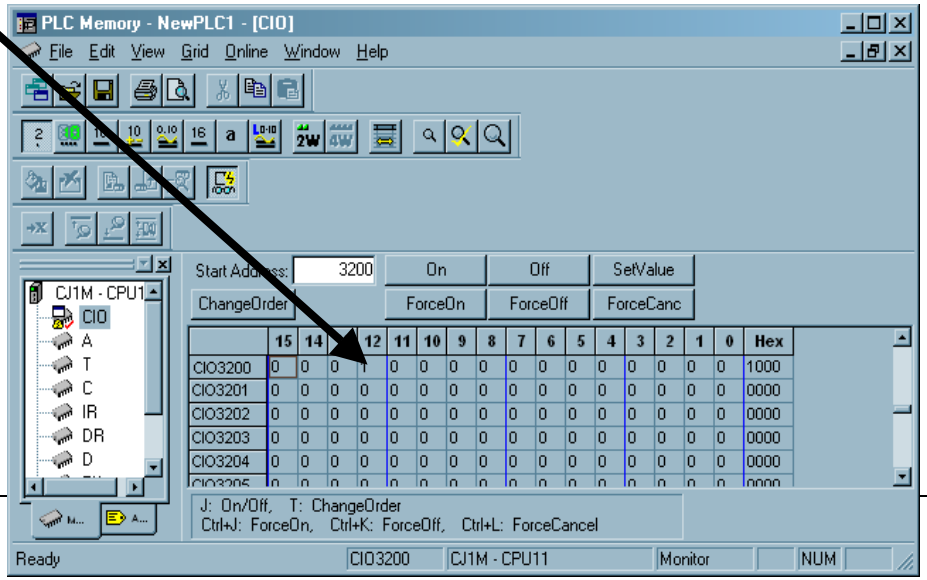
Left PLC prog view

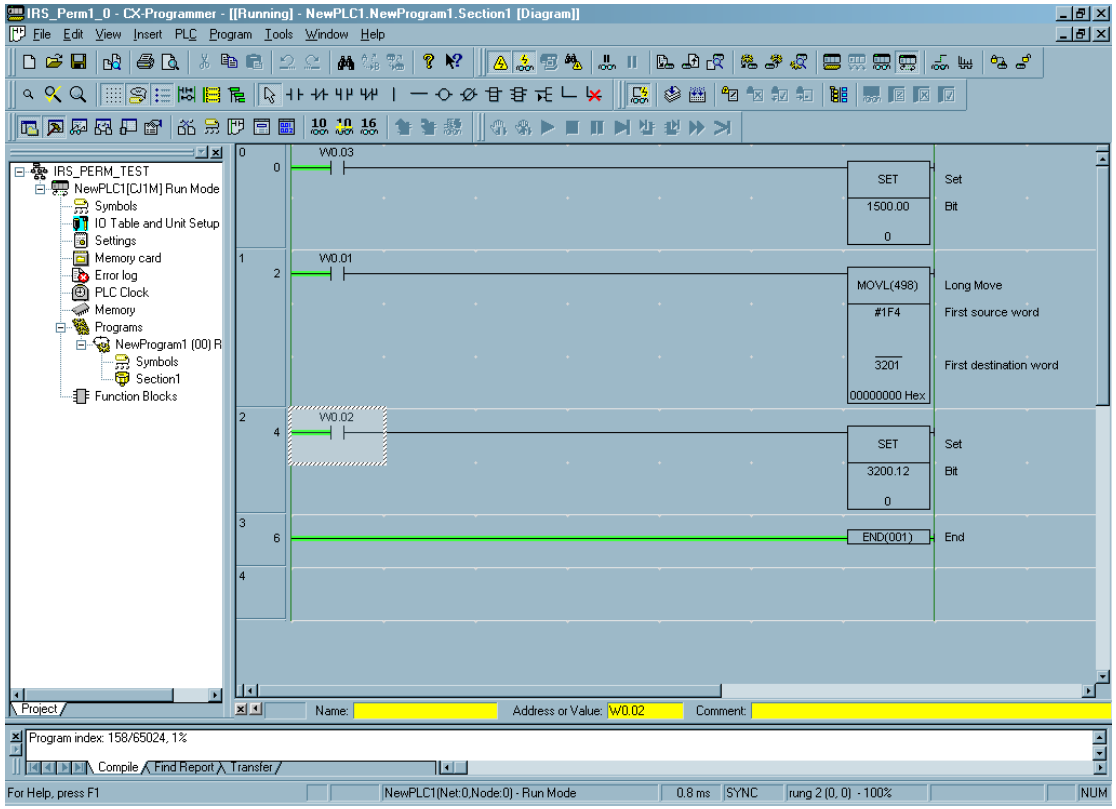



PLC Memory - NewPLC1 - [CIO]
IRS PLC
Start Address: 3302
On
Off
SetValue
ChangeOrder
ForceOn
ForceOff
ForceCanc
CJ1M - CPU1
CIO
A
T
C
IR
DR
D
CIO3300 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 8000
CIO3301 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0000
CIO3302 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0000
CIO3303 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0000
CIO3304 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0000
3300.15 = 1
Supply faulty
J: On/Off, T: ChangeOrder
Ctrl+J: ForceOn, Ctrl+K: ForceOff, Ctrl+L: ForceCancel
Ready
CIO3302
CJ1M CPU11
Monitor
NUM

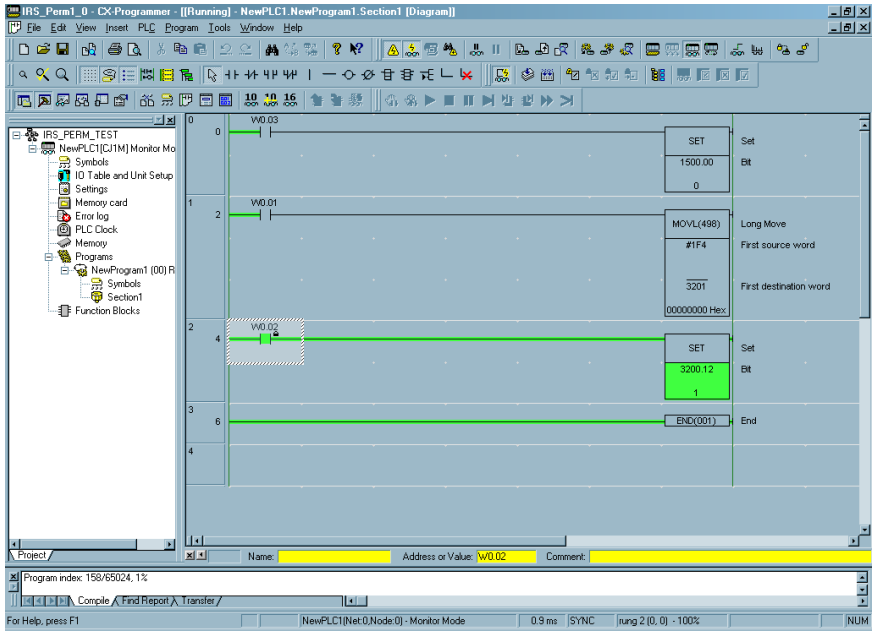
Oven ON – No 400 V– No setting => Sector Default

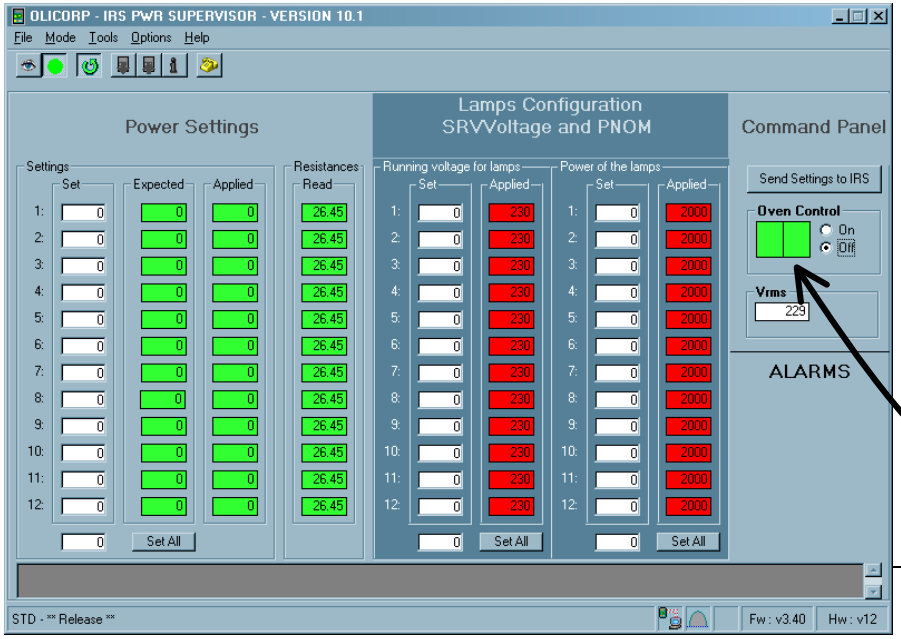


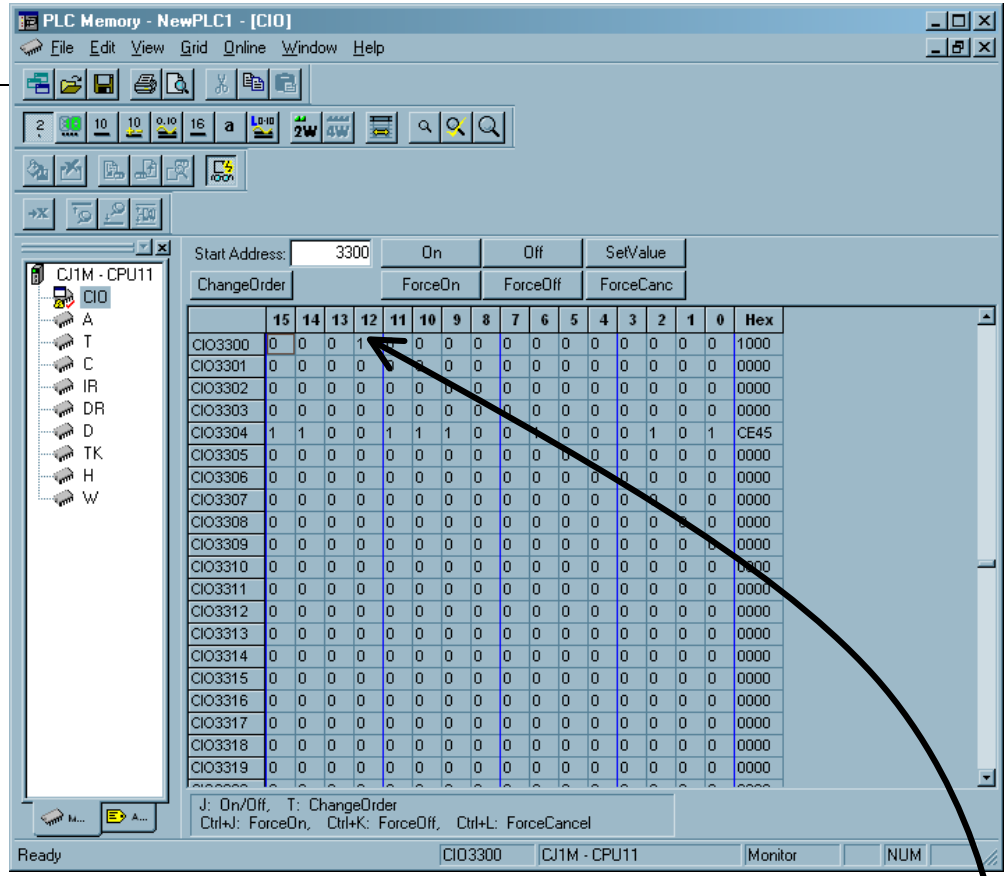

PLC Memory - NewPLC1 - [CIO]
Start Address: 3200
On
Off
SetValue
ChangeOrder
ForceOn
ForceOff
ForceCanc
CJ1M - CPU1
CIO
A
T
C
IR
DR
D
CIO3200 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 1000
CIO3201 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0000
CIO3202 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0000
CIO3203 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0000
CIO3204 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0000
J: On/Off, T: ChangeOrder
Ctrl+J: ForceOn, Ctrl+K: ForceOff, Ctrl+L: ForceCancel
Ready
CIO3200
CJ1M - CPU11
Monitor
NUM



Turning oven off will reset the default.



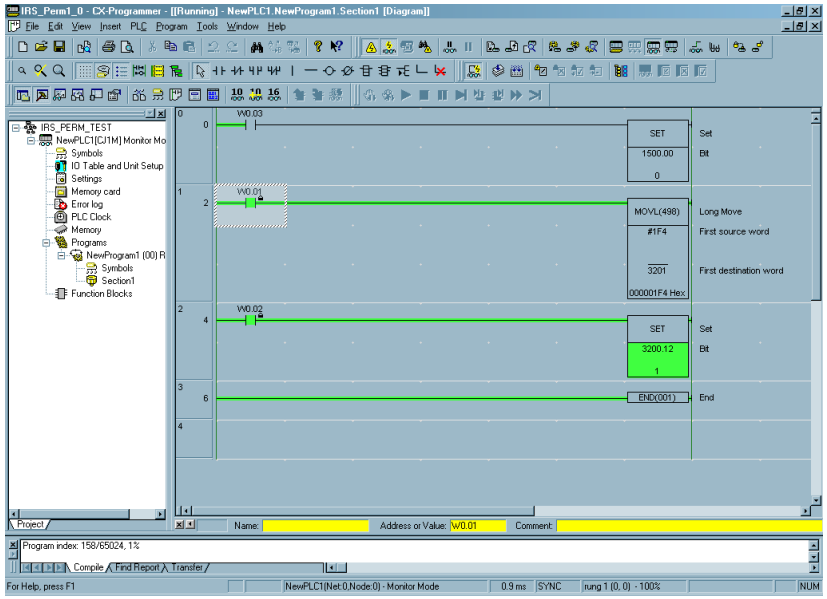


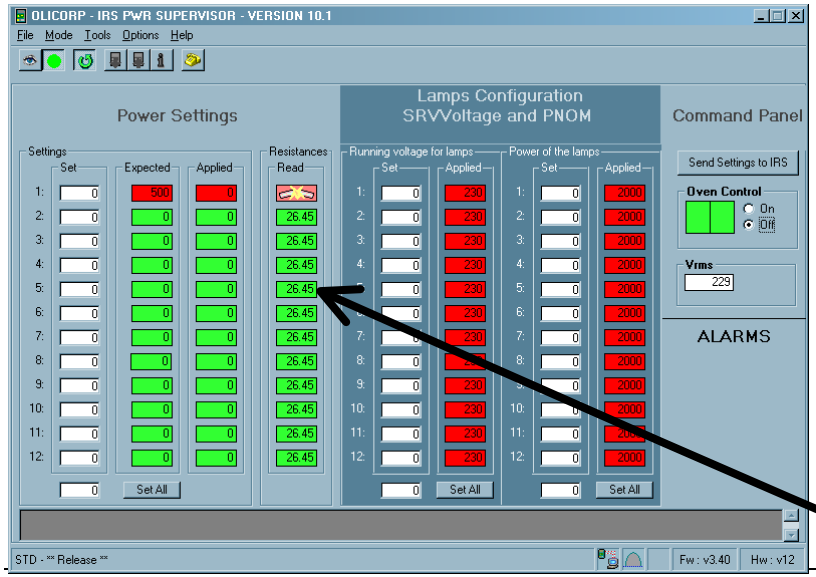


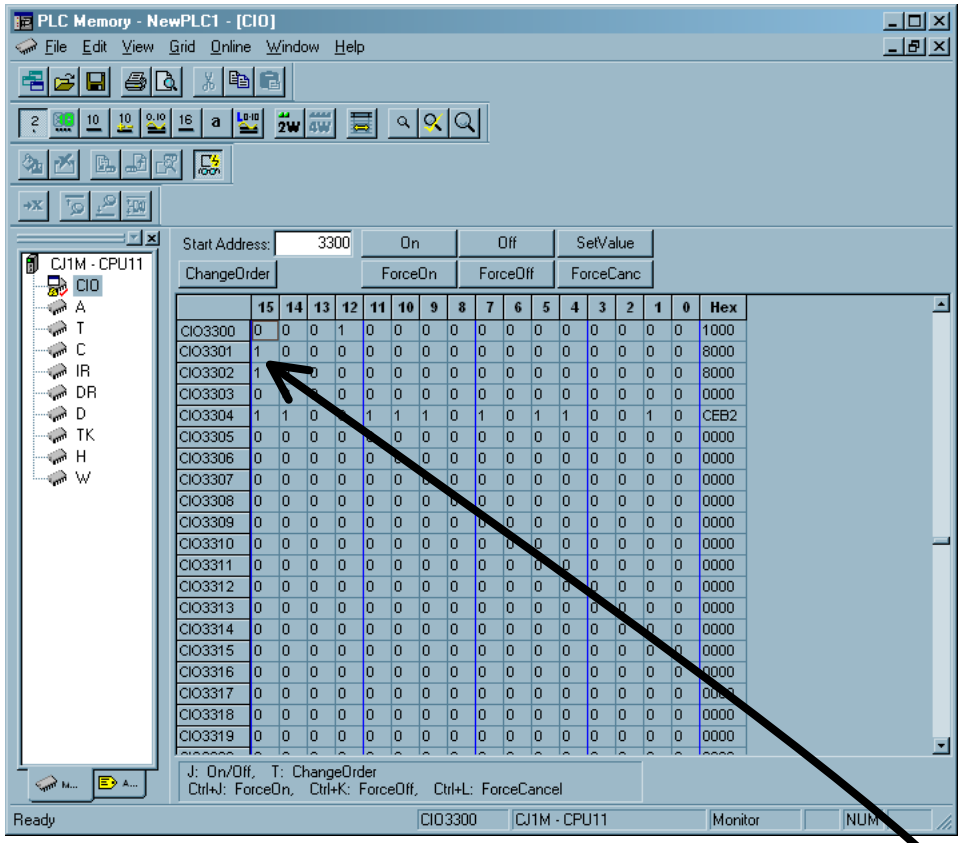
Turn ing Oven on with 400 On.

No Alarm.

Supervisor and PLC show ON STATE for OVEN

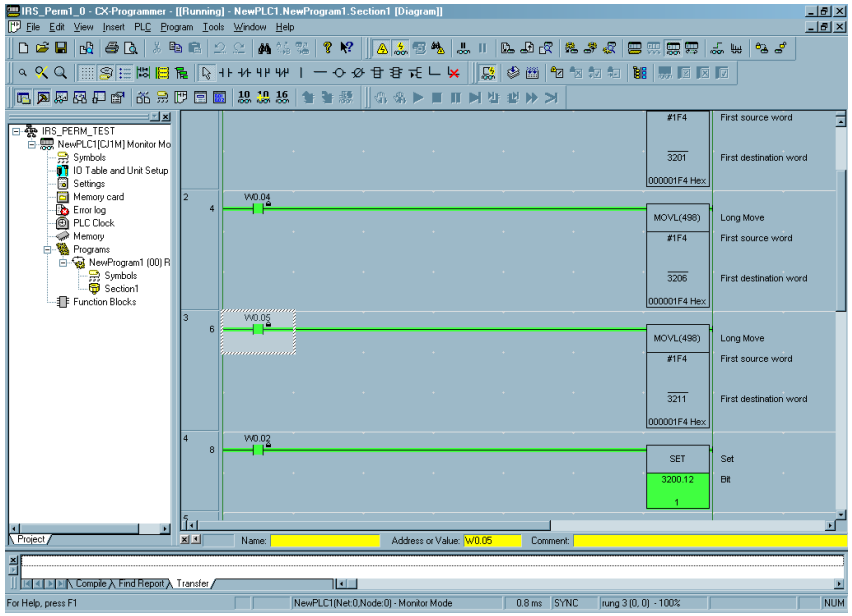


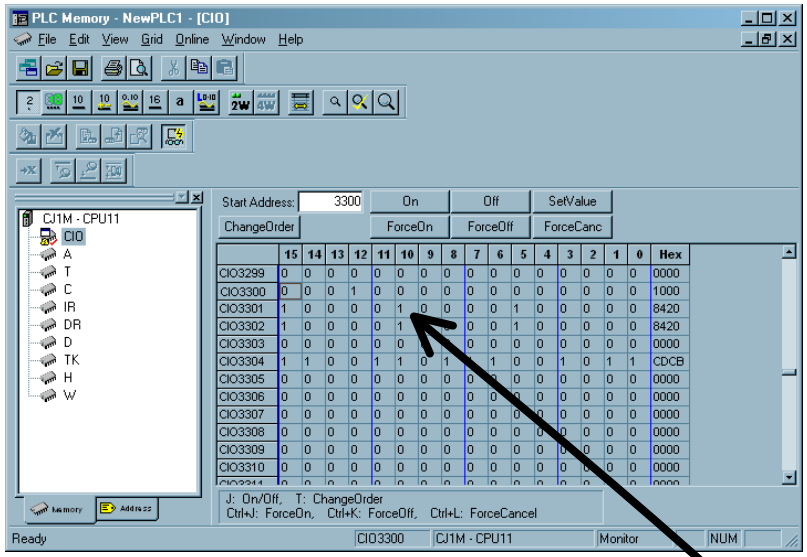


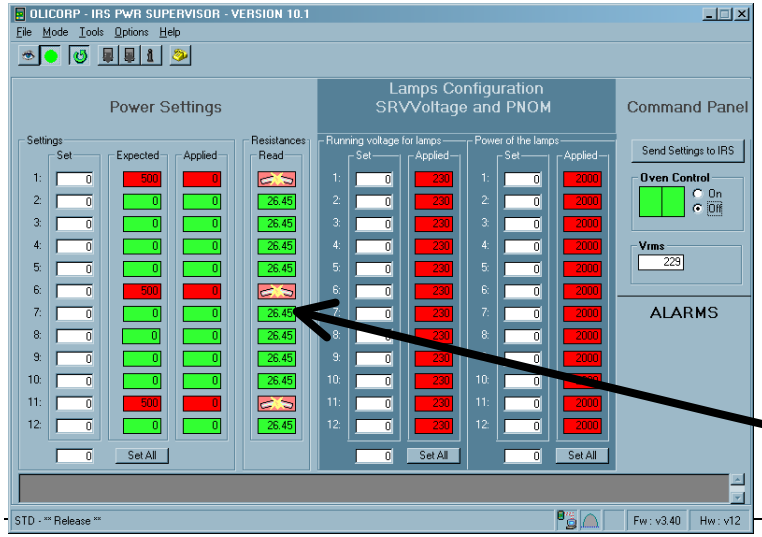


Send Set point to lamp 1 : 500 W .

No lamp is connected the IRS sends a Power not reached and Dead lamp alarm.





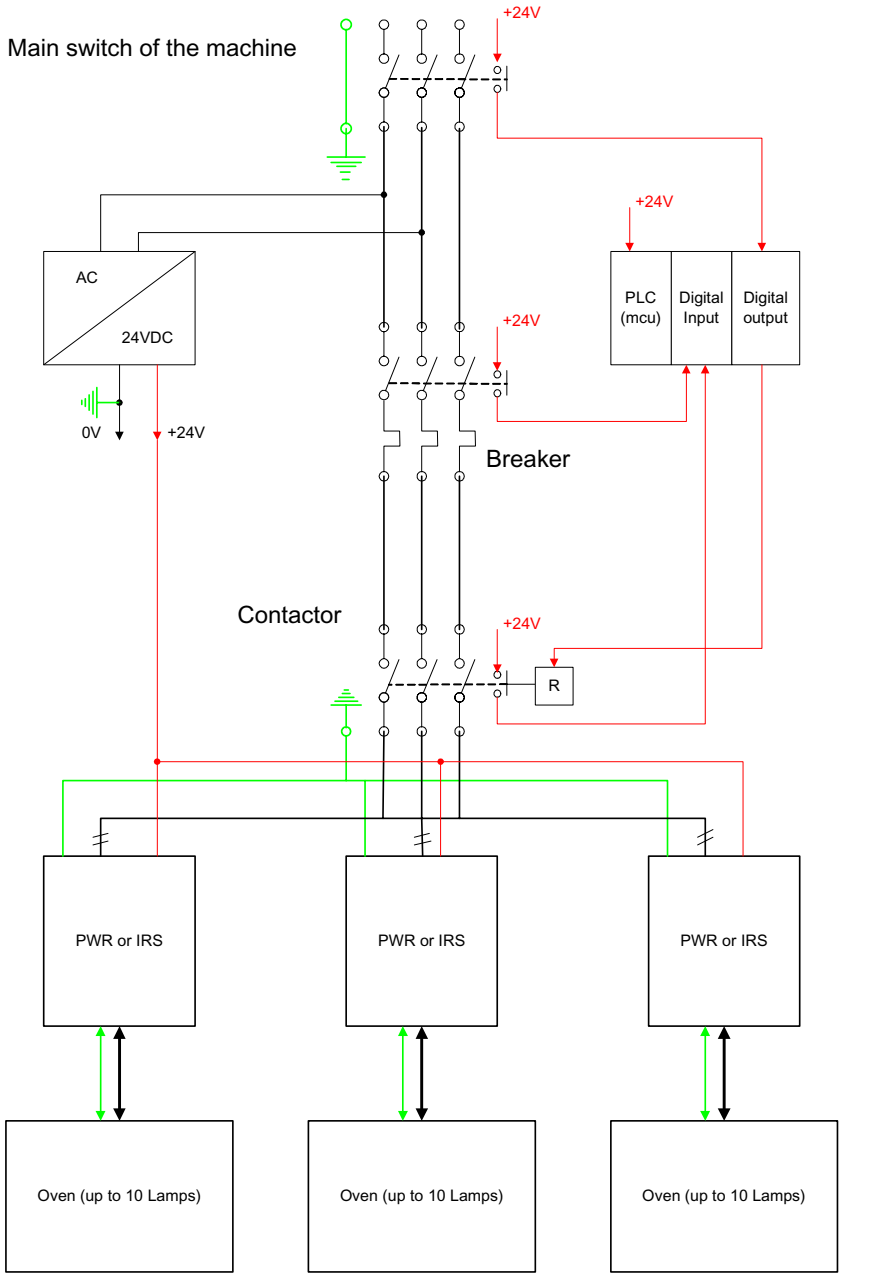


Turning on lamp 6 and 11.

No lamp is connected the IRS sends a Power not reached and Dead lamp alarm.

PART 2 : ELECTRICAL INTEGRATION AND AUTOMATION

Standard design of the electrical power supply :



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Architecture of the automation program :

Program example :